DOCUMENT RESUME

ED 323 922 IR 014 545

AUTHOR Christensen, Dean L.
TITLE Fourth Generation Instructional Design Model: An Elaboration on Authoring Activities.
PUB DATE Feb 90
NOTE 16p.; In: Proceedings of Selected Paper Presentations at the Convention of the Association for Educational Communications and Technology; see IR 014 535.
PUB TYPE Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Computer Assisted Instruction; *Instructional Design; *Instructional Development; *Instructional Systems; Models
IDENTIFIERS *Instructional Systems Design

ABSTRACT

This paper presents the updated (fourth generation) version of the instructional design (ID) model, noting its emphasis on a scientific, iterative approach based upon research and theory in learning and instruction and upon applied development experience. Another important trend toward a scientific approach to instructional design is the increased emphasis placed on the use of evaluation not as a last step but as an integral part of the design system. The various facets and combinations of the updated ID process (Analysis, Analysis-Design, Analysis-Maintenance, Design, Design-Development, Design-Development-Implementation, Development-Implementation, Development-Implementation-Maintenance, Implementation, Implementation-Maintenance, and Maintenance) are presented in terms of the authoring activities associated with each facet. A diagram of the model is included. (6 references) (GL)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED323922

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

This document has been reproduced as received from the person or organization originating it.

Minor changes have been made to improve reproduction quality.

Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

Title:

Fourth Generation Instructional Design Model: An Elaboration on Authoring Activities

Author:

Dean L. Christensen

IR014545

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Michael Simonson

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Fourth Generation Instructional Design Model:
An Elaboration on Authoring Activities

Instructional Design

Instruction is a process that involves both the planning of an environment where learning can take place and the delivery of information to the learner. How to improve learning in a planned environment has been a major concern of educational psychologists since the first formal research on classroom learning by Edward L. Thorndike (1969). Since Thorndike, learning in the classroom (or training) environment has been a focus of educational psychologists who, unlike experimental psychologists who have limited their study of learning to the laboratory, consider the complexity of factors that influence the effectiveness and efficiency of classroom instruction on improving learning.

Factors that contribute to the divergence in student learning include cognitive and affective variables, student knowledge, stimulus properties, delivery system (e.g., lecture, computer, video, etc.), management procedures (e.g., program control, learner control), instructional strategies, and evaluation methods.

Although educational psychologists, as well as other educators, have long dealt with these factors, it has only been in the past decade that they have investigated variables and conditions directly related to the planning of a total learning environment; that is, recognizing the interaction of multiple factors that go into designing and implementing instruction. Instructional systems design (ISD) is the term applied to this planning effort; it includes the processes of development, evaluation, and

management. The ISD concept of development uses a scientific process that involves both the planning of an environment where learning can take place and the delivery of information to the learner.

Growth of this approach to instructional design has been facilitated by major inputs from fields of inquiry outside of education, such as computer science, management information sciences, and psychology; and within the field especially from instructional technology. Whenever possible, research and theory from these areas have been applied to appropriate phases in the updated ID model. Of these areas, computer science has had a major impact with such contributions as system design strategy variables (e.g., system architecture and software developments), structure of information (both as external information and internal representations), efficiency of design concepts (e.g., heuristic methods), and alternative learner control methods.

In the updated ID model the emphasize is on the basic principles of design using an iterative approach to development rather than a conventional algorithmic process model in which the output of one step becomes the input for the next. This is done for two reasons. First, the complexity of the ID process is a result of alternatives available for solving domain- specific learning problems. Thus, within phases the author has numerous options to be organized to fit the given situation. Second, the authoring activities can be independent of the decision making. Thus, in the design of an expert instructional design system, the knowledge base can be separate from an executive strategy system.

The principles of design in the updated ID model are based primarily upon learning and instructional research and theory and, just as importantly, upon applied development experience. It is one thing to talk and write about the instructional

design process, and quite another to have actually done it. As a design science field, much like engineering, instructional design relies upon field experience for much of the "how to do it" components of its system. In this regard, the conglomerated authoring activities exhibit different degrees of theory-base and empirical base. For example, the analysis draws heavily on learning theory to set the conditions of learning and evaluation. In contrast, the development draws on field experience to define activities.

Another important trend toward a scientific approach to instructional design is the increased emphasis placed on the use of evaluation (Tennyson, 1978; also Tennyson paper AECT 1990). Although evaluation has always been part of the instructional design plan, it traditionally was relegated to the last step in the process. Even the most recent models (e.g., Merrill, 1983; Reigeluth, 1983) have only a minimal consideration of evaluation. The impetus for increased use of evaluation in development is part of a larger societal movement towards accountability in education and training. Following the guidelines presented by Tennyson's theory-based model (Tennyson, 1990), evaluation has become an integral part of the design system.

The various facets and combinations of the updated ID process (4th generation)--Analysis, Analysis-Design, Analysis-Maintenance, Design, Design-Development, Design-Development-Implement, Development-Implement, Development-Implement-Maintenance, Implement, Implement-Maintenance and Maintenance will be presented in terms of the authoring activities associated with each facet of the updated ID model. Figure one presents the updated ID model (fourth generation) as a dynamic processing model in reference to the elaboration of authoring activities (for further detail on updated ID model see Tennyson's presentation and paper).

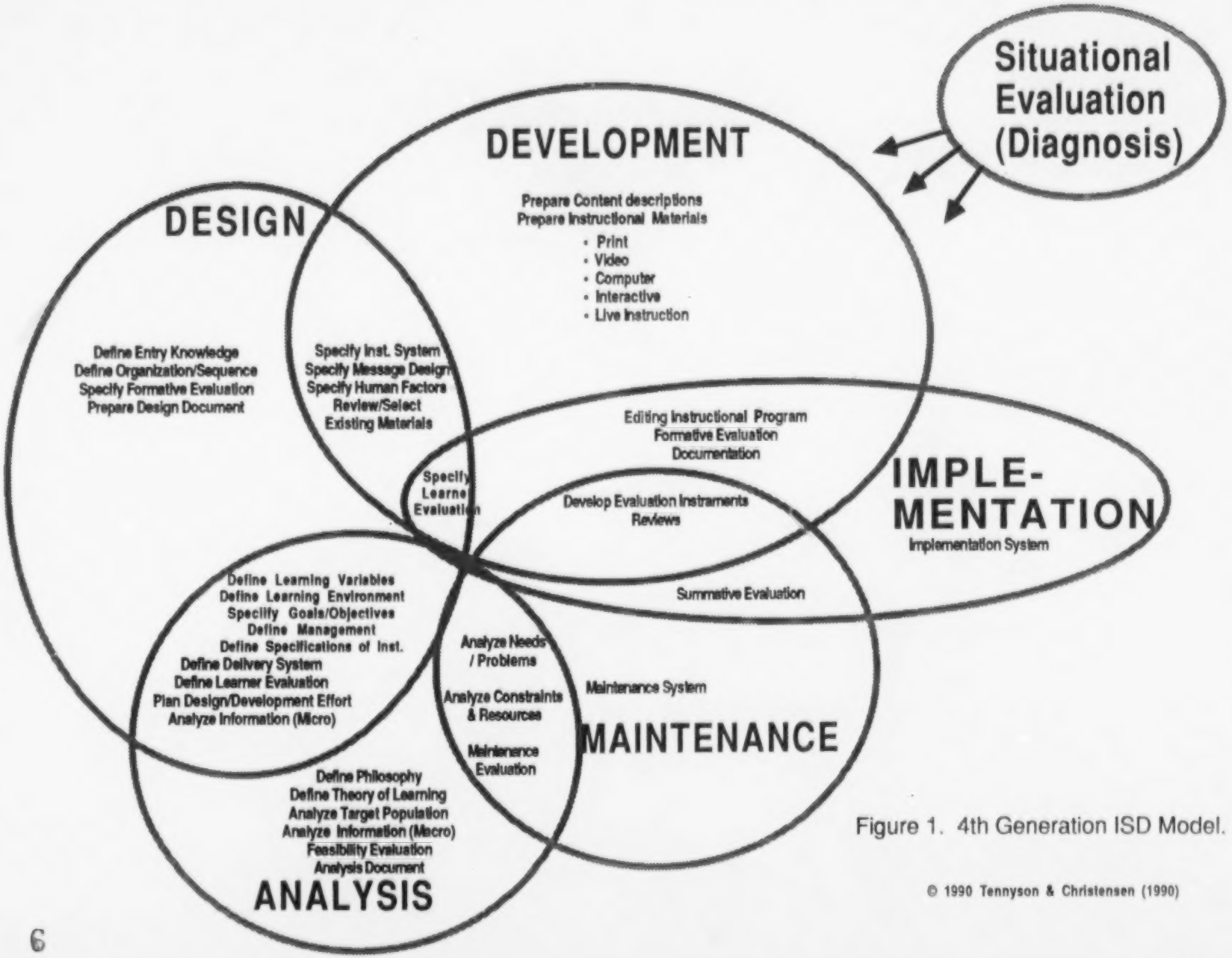

Figure 1. 4th Generation ISD Model.

© 1990 Tennyson & Christensen (1990)

Analysis	Authoring Activities
Define philosophy and theory of learning conditions	These conditions influence each step in the ID process Thus, the generic steps are adjusted to account for the defined
Analyze target population	Determine learner characteristics: geographic location, age, ability, need for motivation, present skill levels, number of students Determine learner differences: cognitive style, aptitude, learning style, personality factors, motivation, perception
Feasibility evaluation	Validate the analysis process
Analyze document	Establish conditions of the learning environment conditions
Analysis-Design	
Define learning variables	Identify specific information to be learned
Define the learning environment	Establish scope and constraints of the ID process

Analysis-Design	Authoring Activities
Specify goals	State abstract descriptions of what knowledge is to be acquired (levels of knowledge—declarative, conceptual, and procedural)
Specify learning objectives	State objectives for learning program, specifying: desired conditions of learning (e.g. verbal information, intellectual skills, cognitive strategies, motor skills, attitudes)
Define management and delivery system	Establish role of computer in management of the learning environment Identify basic goals for computer delivery of instruction (and identify other alternative systems; e.g., interactive video)
Define specifications of instruction	Document conditions and specifications of program: length, structure, proportion presented by allowable media, target population description, definition of constraints, goals and information to be covered, levels of program intelligence within management and instructional system

Analysis-Design	Authoring Activities
Plan design and development effort	Consider whether to: buy and use existing materials, modify an existing course, develop a new course, or discontinue development effort Estimate costs and resource requirements for each alternative
Analyze information (micro)	Knowledge engineering activities: Identify organization of information Establish knowledge base Determine schematic structure from knowledge base (referenced to conditions of learning) Determine schematic structure from semantic structure Determine semantic structure for content attribute characteristics
Analysis-Maintenance	
Analyze learning needs and/ or problem	Identify discrepancies between desired and actual learning and performance Determine consequences of learning and performance discrepancies
Define constraints restricting resolution of learning and performance discrepancies.	Identify the scope of the need/problem (i.e., curriculum, course, module and/or lesson)
Maintenance Evaluation	

Design	. Authoring Activities
Define entry knowledge	Identify and determine learner entry knowledge and behaviors Determine learner (student) model: background knowledge, associative knowledge, prerequisite knowledge, prior knowledge
Define organization and sequence of information	Determine sequence of information through: a) course, b) module, c) lesson
Specify formative evaluation system	Outline strategy for validating learning materials
Prepare design document	Document all design decisions to guide development of prototype learning materials
Design-Development	
Specify instructional system	State Meta-instructional strategy
Specify meta-instructional strategies	Specify use of meta-instructional strategy variables: drill variables, placement of items, display time, label

Design-Development	Authoring Activities
	definition, context, best examples, expository examples, interrogatory examples, strategy operation, attribute elaboration
Specify mode of interaction	State level of system interaction: program initiative, mixed initiative
Specify screen management	Determine screen layout, positioning, sizing, etc.
Specify presentation modes	Select input/output modes: keyboard, positional, speech
Specify computer-based enhancements	Select computer-based enhancements: worked examples, display time, format of examples, amount of information, sequence, embedded refreshment & remediation
Specify methods of management	Design method of management per selected level of intelligence: flowchart, algorithmic, heuristic
Specify message design	Select display characteristics (e.g., graphics, text, color) Design screen layout

Design-Development	Authoring Activities
Specify human factors	Design: menus, function key prompts, special helps glossaries Identify hardware configurations
Review/select existing materials	Select portions of existing materials appropriate for inclusion
Define situational variables	Identify existing materials, compare them with needs/problem Identify source manuals, subject matter experts, and resource people
Design-Development- Implement	
Define conditions of learner assessment/evaluation	Determine the method(s) for assessing and evaluating learner knowledge acquisition (e.g., methods of diagnosis, error detection, error analysis)
Specify learner evaluation system	Determine on-task learning assessment and level of diagnosis (e.g. preventive, overlay, reactive, advisement, coaching) Determine use to be made of pretests, progress checks, and posttests Determine how assessments are to be administered (i.e., by computer or by paper)

Development	Authoring Activities
Prepare content narratives	Acquire and document subject matter content (i.e., knowledge base and schematic structure)
Prepare learning activity designs	Review learning activity designs and associated content for adherence to design and for accuracy and completeness
Develop learning activities	Employ strengths of medium Implement instructional strategies
Development-Implement	
Editing of learning program	Establish format and composition requirements Review all materials for grammar, style and consistency
Formative evaluation	Conduct one-on-one tryout of prototype materials Revise on the basis of one-on-one result Conduct simulation tryout Refine on the basis of simulation test Edit and produce Perform technical and mechanical review
Documentation	

Design Implement-Maintenance	Authoring Activities
Develop assessment instrument	Develop items appropriate for each objective and learning activity Develop items consistent with designed assessment system
Reviews	Subject matter experts review material for accuracy and completeness Designers review material to determine whether it meets requirements established in analysis and development phases
Implement	Reproduce materials Establish/modify support services Distribute materials Deliver instruction Collect data on learner performance and learner attitude
Implement-Maintenance	
Summative Evaluation	Analyze data Distribute report and recommendations Determine whether to make major revision (go to Analysis) or minor maintenance (go to Maintenance)

Maintenance	Authoring Activities
	Perform maintenance on learning activities and test items.

References

Merrill, M. D. (1983). Component display theory. In Reigeluth, C. M. (Ed.), *Instructional-design theories and models: An overview of their current status..* Hillsdale, NJ: Lawrence Erlbaum Associates, Publishers.

Reigeluth, C. M. (1983). *Instructional-design theories and models: An overview of their current status.* Lawrence Erlbaum Associates, Inc.

Tennyson, R.D (1990, February). Instructional design theory: Advancement from cognitive science and instructional technology. In D. Jonassen (Chair). *Research in computer-based instruction: Implications for design and authoring systems,* Symposium conducted at the meeting of the Association for Educational Communications and Technology, Anaheim, CA.

Tennyson, R.D. (1978). Evaluation technology in instructional development. *Journal of Instructional Development, 2* (1), 19-26.

Tennyson, R. D. & Breuer, K. (1984). Cognitive-based design guidelines for using video and computer technology in course development. *Video in Higher Education,* 26-63.

Thorndike, E. L. (1969). *Human nature and social order.* Cambridge, MA: Massachusetts Institute of Technology Press.